

What is claimed is:

1. A buoy system for bi-directional communications in air and underwater comprising:

a buoy having a hollow shell on water, said shell having an upper portion to project in air above the surface of water and a lower portion to extend below the surface of said water;

an array of acoustic transducers in said lower portion for receiving acoustic signals in the passive mode and for transmitting acoustic signals in the active mode through said water; and

a retro-reflective coating on said upper portion, said retro-reflective coating being dome-shaped and vibrated in accordance with data signals for retro-reflecting impinging laser illumination signals and conveying said data signals as retro-reflected data signals, and said retro-reflective coating being vibrated in response to impinging laser control and information signals at said buoy.

2. The system of claim 1 further comprising:

an array of photo-detectors on said upper portion responsive to said impinging laser control and information signals for generating activation signals.

3. The system of claim 2 further comprising:

a control/memory module, optical processing module, and acoustic processing-electronics section in said hollow shell for receiving said activation signals, said control/memory module and acoustic processing-electronics section coupling received acoustic signals from said transducer array and from memory as said data signals to said retro-reflective coating.

4. The system of claim 3 further comprising:

a GPS in said control/memory module for covert identification of position of said buoy, said GPS being connected to an antenna on said shell to receive GPS coordinates and, optionally, relay the position of said buoy.

5. The system of claim 4 further comprising:

an array of electro-mechanical vibration shakers inside of and against said upper portion of said hollow shell, said vibration shaker array being driven by said optical processing module for vibrating said retro-reflective coating.

6. The system of claim 5 further comprising:

an annular array of accelerometers being connected to said optical processing module for measuring the three dimensional displacements of said retro-reflective coating to provide signals representative of accelerations during said displacements.

7. The system of claim 6 further comprising:

transducer elements interspersed with said vibration shaker array under said dome-shaped retro-reflective coating, said transducer elements being connected to said optical processing module for generating signals representative of said impinging laser control and information signals.

8. The system of claim 7 wherein said representative generated signals from said transducer elements are coupled to said control/memory module to initiate retrieval of the information of received acoustic signals from said transducer array and memory in said control/memory module.

9. The system of claim 8 further comprising:

a transmit/receive switch connected to said control/memory module, said acoustic processing-electronics section, and said transducer array to selectively enable operation of said transducer array in the passive mode and the active mode.

10. The system of claim 9 further comprising:

an acoustically transparent cover on said lower portion of said shell over said transducer array;

a power supply in said shell for supplying electrical power for all components therein; and

ballast chambers in said shell for maintaining buoyancy and proper vertical orientation of said shell.

11. The system of claim 10 further comprising:

a remote platform having at least one laser onboard for transmitting said impinging laser illumination signals and impinging laser control signals through said air, and a laser Doppler vibrometer-based sensor responsive to receive said data signals as said retro-reflected data signals through said air.

12. The system of claim 11 wherein said system assures covert bi-directional communications with said illuminating and retro-reflected laser signals in said air to initiate control including acoustic transmission of acoustic signals in said water, acoustic reception of acoustic signals in said water, and optical transmission of data of said received acoustic signals in said air by said retro-reflected laser signals.